

The Cycle of Ideas in Research, Development and Technology Transfer

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When people talk about research, development and technology transfer (RTD in short) and commercial industrial activities, it is quite usual to mix up objectives, resources and responsibilities. There is a growing opinion, spread by some public administrators and the media, that research groups at universities and RTD centers must be "profitable". In few words, many persons would wish that research is funded with competitive funds or even loans (either public or private) and that the outcomes of the research get into the market rapidly, so that the profits from marketing the corresponding products will allow research groups to be financially self-sustaining.

It is also usually argued that companies should increase their research activity and invest more resources in finding new discoveries. The humoristic limit of this situation is pretending that companies will produce Nobel laureates and that a research group would be among the 10 first positions in the ranking of economic organizations in a country. Certainly, both these situations are not impossible, although they are highly improbable. The opposite case is, unfortunately, more frequent, ie. that researchers compelled by their needs to guarantee the financial survival of their groups, abandon or considerably reduce their fundamental research activities, and that companies, confusing what is a Technical Department with an Innovation Department, consider themselves self-sufficient and underestimate or ignore the contact with the real RTD world.

How the Cycle works

Above concepts can be clarified if we examine what we call the **Cycle of Ideas**. Figure 1 shows a scheme of the transit of an idea, from the instant it originates until it is transformed in an industrial and commercial success. Similarly as it happens in other biological environmental cycles (the water cycle or the cycle of plants, for instance), the cadencies and tempos are very important and their perturbation can lead to negative results.

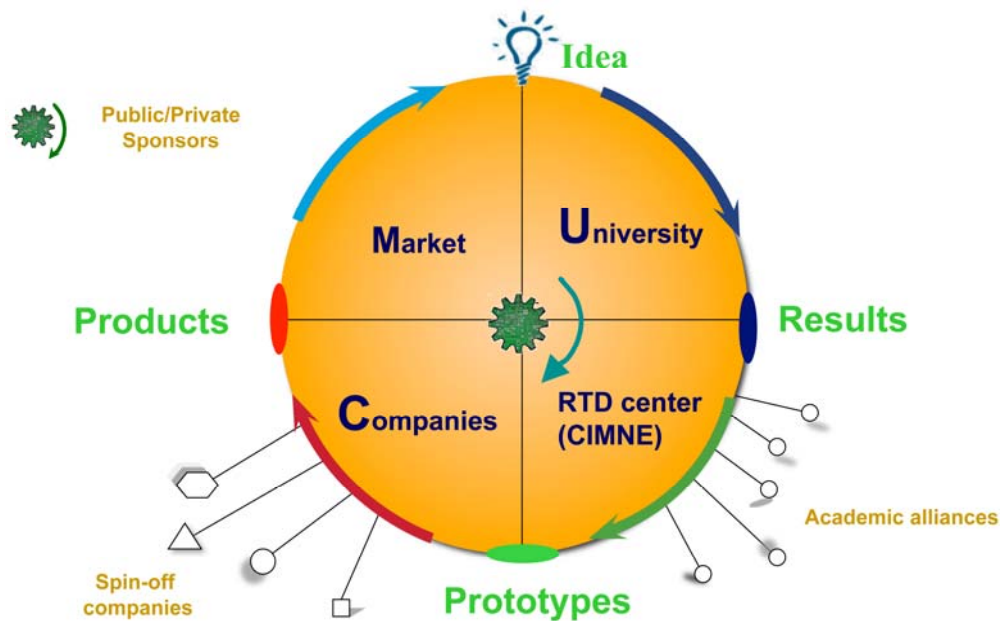


Figure 1. The Cycle of Ideas

Ideas (and I basically refer here to scientific advances) usually originate in university environments, where many professionals have the mission of thinking, studying, investigating and eventually discovering new areas of knowledge. The idea (the new discovery) would be equivalent to a seed, in the sense that even being very important (essential) it is far from becoming a fruit.

The idea matures in its "*tour*" by the first quadrant of the Cycle (the University) until it produces tangible results (thesis, papers, computer programs, physical devices, etc.). These "results", if they are not filed and protected, can be easily lost. This leads to undesirable repetitions or duplications.

What to do then with the results of an idea?. The best is that they can evolve until they reach the level of a prototype; ie. until they became something (a software code, a system, a device, etc.) that works in a contrastable manner in the hands of a person different from the author. The transit of a *result* to a *prototype* is not a trivial one and it demands an organization, efficient and capable staff and resources that are usually far from the ordinary means of a university group. The best alternative is, therefore, that the idea follows its route on specialized institutions, adjacent to the university, with the specific mission to transform knowledge into tangible things (prototypes).

Many organizations of this type have been created around the world in the last years. An example is the International Center for Numerical Methods in Engineering (CIMNE, www.cimne.com) in Barcelona, Spain. Some of these organizations are called Research Centers and others Innovation Centers. This terminology is sometimes deceiving, as it apparently indicates that some centers must focus in research and not in technology transfer, and vice-versa. The truth is that research and technological development are essential activities in both type of, so called, RTD centers. What is important is that they should have the capability of teaming up with research and industry environments with a practical vision.

University and enterprise

Can a prototype be released into the market with a guarantee of success?. The answer is (probably) no. The distance between a prototype and a product is typically a long one. Getting a product is an objective in itself and mixing it up with RTD tasks is not advisable and leads to frustrations. Products should be developed in companies where specialists devote their time and talent exclusively to obtaining, validating and documenting a product, as well as to defining the marketing plan.

Once a product has finally reached the market, it would enter into the last quadrant of the Cycle of Ideas. There the objective is commercial success. In order to reach that, the company should establish the necessary alliances around the world. The Cycle ends up with the return of a part of the profits from the marketing of the product to the place from where the idea originated (the University).

Clearly, the "rotation speed" of the idea around the Cycle can be increased with the help of funding from external public and private sponsors, as it is metaphorically shown in the figure.

These concepts are in fact very simple. However it is typically very difficult to put them into practice. What are the difficulties?.

Some difficulties

Among the difficulties that prevent good ideas to become a full industrial (and commercial) success story, I would focus just in three that are based on my own experience. The first one is the lack of perception of the limits of an organization. Humans are limited and so are organizations. In practice, things are only done at its best within the limits of a person or an institution. For instance, universities and research centers have not the competence of an enterprise, and vice-versa. To act beyond the *limits of competence* is a temptation to

which many groups in universities, research organizations and enterprises frequently fall. There are indeed very few examples of successful "unlimited" organizations.

The second difficulty is the usual lack of adequate *interfaces* between the different agents that are involved in the transformation process of an idea. These interfaces require, among other things, persons with the capacity of understanding the problems and requirements at both sides of the "quadrants".

Finally, I mention the importance of *good alliances* in all directions. University and research groups should weave around them a network of industrial and academic organizations with complementary skills at national and international levels that will help them to develop and exploit knowledge with a guarantee of success. Again from my own experience I refer to the network of CIMNE Classrooms in Spain and Latin America and the spin-off companies created by CIMNE.

Policies

If the above concepts are accepted, then we can guess better the difficulty and/or convenience of implementing one or other policy for stimulating RTD work at universities, research centers and companies. It is non credible that a university or a research center can get a profit from the exploitation of the outcomes of an idea in the short/mid term. Consequently, the policy of some Government agencies of providing reimbursable loans instead of grants for funding research in universities and research centers, has a high probability of failure, in the sense that they will not be able to return the loans on time. A more interesting (and feasible) approach will be that parts of the grants are linked to the success in the research, validated in the form of contrastable results. On the other hand, the policy for funding innovation work in companies should include the modality of non-returnable loans for happy-ending histories in the achievement of an innovative product.

The right policy should put the emphasis in reaching a successful end in the RTD activity, and not in the RTD work in itself, as it is the usual case. The target would be always the same, helping that an idea becomes something useful and profitable.

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